II. *On the Structure of the Tarsus in the Tetramerous and Trimerous Coleoptera of the French Entomologists. By W. S. MacLeay, Esq. A.M. F.L.S. Communicated by the Zoological Club of the Linnean Society.*

Read February 1, 1825.

Each succeeding day proves more and more the importance to Natural History of the utmost particularity of detail. This science is one in which correct general views can only be constructed on a minuteness of scrutiny which may be tiresome, nay, to some minds, even disgusting, but can never be unprofitable. The collector who consults books merely that he may be enabled to attach a label to some object in his museum, is as much interested in our observations being minute, as the naturalist whose study it is to ascertain the affinities and analogies which connect together all organized beings. It is only, indeed, upon minute observation that accurate descriptions can ever be founded; and it is therefore impossible for such persons as will not deign to descend into details to attain even mediocrity as naturalists. The entomologist then may say, on behalf of the minute objects which he studies and the minuteness with which he describes them, that unless a similar minuteness of observation be carried into the study of *Mammalia* and Birds, even in these important classes of the creation nothing that is certain as to affinities, nothing that is definite in nomenclature, can ever be attained. Yet even in Entomology, a science of which strict scrutiny is as it were the charac-

characteristic, we may daily perceive that accurate observation remains still a desideratum, merely because we are too apt to despise minutiæ, and too ready to adopt the recorded observations of others as true, for no other reason than because they are so recorded. A curious instance of this facility in trusting to the observations of others I shall proceed to explain; not merely because it has led myself as well as all other modern entomologists into very inaccurate descriptions, but because a system of arrangement, and that system the very one which is most prevalent on the Continent at the present day, has been founded among coleopterous insects upon such false descriptions.

Geoffroy appears to have been the first to observe that the joints of the tarsi varied in number among *Coleoptera*, and also to have been the first to make use of this variation in forming a system of arrangement for the order*. In alluding to this system of Geoffroy, M. Latreille says, "L'ouvrage de ce celébre naturaliste est peut-être celui qui a le plus contribué aux progrès de l'Entomologie, du moins en France. On lui doit la découverte du caractère important, pris du nombre des articles des tarses, caractère qui a par sa constance une plus grande valeur que celui que fournissent les antennes." (*Lat. Hist. Nat. des Crust. et Ins.* ii. 300.) M. Dumeril improved upon Geoffroy's sketch; while M. Latreille and the other French naturalists fancied that they had found a key to a natural arrangement, the honour of which would indisputably belong to France. In the *Genera Insectorum* of M. Latreille, a work which has occasioned the tarsal system to be generally adopted not merely in France but throughout Europe†, we find that the great order of *Coleoptera* is divided into five

* De Geer, *Mém. pour l'Hist. des Ins.* vol. iv. p. 7.

† Until the publication of the first number of the *Annulosa Javanica*, no English entomologist had so far broken through the trammels of this system as to arrange insects in opposition to it, except Dr. Leach, who in the 3rd volume of the *Zoological Miscellany*

five sections: the *first* consisting of *Pentamera*, or insects having five articulations to each of the tarsi of their six feet; the *second*, of *Heteromera*, or insects having five articulations to the tarsi of the four anterior feet, and only four to those of the two last; the *third* consisting of *Tetramera*, or insects having four articulations to each of the tarsi of the six feet; the *fourth*, of *Trimera*, or insects having each of the tarsi with only three articulations; and the *fifth*, of *Dimera*, or insects possessing only two articulations to each of the tarsi of the six feet. In the *Règne Animal* we have a sixth section added to these, called *Monomera*, the insects of which *are said* to have only one joint to the tarsus.

It is unfortunate for this system, that if it be considered as an artificial one, in which all coleopterous insects are to find a place, very little examination is sufficient to prove that multitudes of *Coleoptera* exist which are neither pentamerous nor monomerous, nor, in short, belonging to either of the above sections; such as, for instance, the typical species of *Onitis*, the males of which appear to have no anterior tarsus*; the genus *Cryptophagus*†, where the males and females differ in the number of joints to their tarsi; the aquatic genus *Hydroporus*‡, which is said to have four joints to the tarsi of the four anterior feet, and five to the two last, &c. &c.: all of which ought to form, by parity of reasoning, so many new sections. It is equally unfortunate that, if this system be considered as a natural one, M. Latreille and others of the more scientific entomologists who have adopted it, appear to have set it at nought whenever it interfered too glaringly

lany and in Samouelle's *Compendium* has most properly placed the *Pselaphidæ* next to the *Staphylinidæ*. In the *Horæ Entomologicæ*, page 6, I attacked the system generally, showing it to be "*by no means natural*."

* *Onitis Sphinx* and its affinities, for instance. In *Onitis Apelles* and its affinities we may, however, observe the tarsus; but then these are species that go off to *Onitiscellus*. See *Horæ Entom.* p. 56.

† *Horæ Entomologicæ*, p. 7. ‡ *Ibid.* p. 7, note.

with their notions of affinity; the consequence being, that although proposed as a natural system, they proved it to be artificial;—as, for instance, in the case of the genus *Heterocerus*, which is acknowledged by them to be tetramerous*, and is nevertheless placed among the *Pentamera*. It was therefore with some shadow of reason that other entomologists, who regarded all similar systems only as they were convenient dictionaries, complained at being called upon to see more than really existed in nature, and to account such an insect to be pentamerous merely because the French system would have it so.

The leading objections, however, which I have made to this system in the *Horæ Entomologicæ* are, in the first place, that it fails *de facto* in its object of superseding the Linnean and Fabrician systems; inasmuch as, instead of giving us a natural series, it has only added to the number of artificial systems already invented; and secondly, that it fails *de jure;* that, in brief, it could not have done otherwise than fail, inasmuch as it has, like most other principles of arrangement, been erroneously applied to divide *Coleoptera*, when the grand requisite must always be the natural method of uniting them. It is indeed, as I have elsewhere attempted to show†, a great error to confound the Creator's distribution of his works with our own method of dividing a subject into heads for the sake of perspicuity. That system, in short, which depends on the division of organs or properties must necessarily be artificial, while that which depends on their *method of variation* must be the natural one.

But I have now to propose a third objection to the tarsal system; an objection which will, I suspect, not a little surprise those entomologists who have been in the habit of adopting it as a convenient mode of arranging the contents of their cabinets. It is, that the very basis of this system is erroneous,

* *Gen. Insectorum*, vol. ii. p. 52. † *Horæ Entomologicæ*, p. 454.

since

since the number of joints in the tarsi of *Coleoptera* does not vary so much as has been supposed. This, it is true, is not an objection that will much affect the series of the *Genera Insectorum*, so far as that work may relate to affinities, because it matters little whether insects are to be held together by being all pentamerous or all tetramerous; but it most seriously affects the nomenclature of the tarsal system,—since, if I place a natural group with five joints to each of the tarsi among *Tetramera*, and another with four joints among the *Trimera*, I clearly give them a false description as well as an erroneous name.

It requires little observation to perceive that Aristotle's group of *Ptilota* is typically pentamerous, or, in other words, that it has in its most normal forms five joints to the tarsus. Aberrant exceptions there are, however, to all rules of this kind; and, as we have seen above, the arrangement of *Coleoptera* given by the French school of naturalists is grounded on such exceptions. Observations universally adopted as accurate, and judged of sufficient importance to form the basis of a system, are not likely to be viewed with suspicion by young naturalists. While, therefore, on entering upon the science, I perceived that the tarsal system was at utter variance with natural affinities, I made no doubt of the statements upon which it was founded being in the main correct. It was certainly evident, as shown above, that this system, as propounded by the French entomologists, would not contain all *Coleoptera;* and, on the other hand, that Illiger and Reichenbach had even exploded the section of *Dimera;* but no one carried his scepticism so far as to express doubts of a Linnean *Cerambyx* and *Curculio* being different from a *Carabus* in being tetramerous, or of a *Coccinella* being properly separated from a *Chrysomela* in being trimerous. The study of natural affinities, however, is of that admirable nature, that, while founded on observation, like a well-proportioned build-

ing it gives superior strength and solidity to that foundation upon which it is constructed: in fact, it seems always to give rise to observations even more beautiful than those from which it has resulted. Thus it was, that in attempting a natural arrangement of the insects collected in Java by Dr. Horsfield, I discovered that the more deeply I penetrated into the science of affinities, the more broken up was the tarsal system. Still, with that respect which we naturally indulge for notions generally adopted, I have confined myself in the first number of the *Annulosa Javanica* to my individual observations*, without venturing to suppose that the French school of entomologists and their followers could be essentially wrong in the very groundwork of their favourite system. Although my confidence in the observations of these naturalists was far from being so implicit as it had been, the reader of the first sixty pages of the abovementioned work will perceive that, instead of attacking the divisions of *Dimera*, *Trimera*, &c. generally, I contented myself with proving my affinities as it were in spite of them; as, for instance, where I admit the *Erotyli*, generally speaking, to be tetramerous, while proving their immediate affinities to be pentamerous. I had scarcely, however, corrected the press of the first number of that work, when Captain P. P. King, R.N. one of those enterprising and accomplished navigators who at the present moment confer so much honour on our country, requested me to examine the insects which he had collected during his late expedition to survey the coasts of New Holland. Among the new forms of *Coleoptera* in this collection I found a pentamerous insect, which I have since named *Megamerus Kingii*†, and

* See *Ann. Jav.* p. 40.

† For the characters of this genus and of *Carpophagus*, see *Narrative of a Survey of the Intertropical and Western Coasts of Australia, by Capt. P. P. King, R.N.* Appendix, p. 447, 448. tab. B. fig. 1 and 2.

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which at first puzzled me not a little as to its natural affinities. On dissecting it, however, and comparing it with the genus *Sagra* on one side, and on the other with a New Holland insect allied to *Bruchus*, which, from the circumstance of its being found on plants of the genus *Banksia*, I have called *Carpophagus Banksiæ*, I ascertained in some degree its natural place. But the *Megamerus* was pentamerous; while *Sagra*, leading off to the Linnean genera *Cerambyx* and *Chrysomela*, and while *Bruchus*, leading off to *Curculio*, were both recorded as tetramerous. It was, however, observable that the tarsus of my pentamerous insect differed in no other respect from that of *Sagra* and *Bruchus;* that is, from the tarsus of the majority of M. Latreille's section of *Tetramera*. The three first joints of its tarsus were in short dilated into species of cushions, of which the last was bilobed, while the fourth joint was short, slender, obconical, and forming at first sight one piece with the fifth; so that the three first articulations formed a dilated part of the tarsus, and the two last a filiform part. Had it not been for the presence of the fourth joint and its remarkable size in the *Megamerus Kingii*, I might indeed have described its tarsus in the very words which in the *Règne Animal* are applied to this part of the foot in the Linnean groups *Curculio*, *Cerambyx*, and *Chrysomela:* "Le dessous des trois premiers articles des tarses est spongieux ou garni des brosses avec le penultième divisé profondement en deux lobes." But on examining carefully *Sagra* and *Carpophagus*, these genera will be found pentamerous in the same manner as *Megamerus*. May it not then be possible, we naturally ask, that the majority of insects hitherto called tetramerous, are in reality pentamerous insects? An accurate examination of any Linnean *Cerambyx*, *Curculio*, or *Chrysomela* will prove it to be so, and that, in fact, the accurate description of the tarsus in these three

three very natural groups is, that it consists of five articulations, of which the three first are dilated into cushions, the third being bilobed, while the two last are filiform, the fourth being very small. But if these insects be thus *pentamerous**, our attention will naturally be turned to the *Trimera* of the French school. May not they also have erroneously been described? Latreille, in characterizing the well-known genus *Coccinella* in Deterville's *Dictionnaire d'Histoire Naturelle*, says, "Trois articles aux tarses dont les deux premiers en cœur et garni des brosses." Yet on examining the *Coccinella* 12-*maculata* of Java, we clearly see that it is at least tetramerous, the two first joints of the tarsus being dilated, and the two last filiform. De Geer has even given a correct magnified figure of a similar structure of the tarsus in

* On this paper being read before the Linnean Society, a short notice of its general purport appeared in the *Philosophical Magazine* for February last; and Mr. Kirby having seen this notice, stated in the following number that he was aware of the facts given to the public in my paper. To this effect he quoted a passage from the forthcoming third volume of his *Introduction to Entomology*. However, in a subsequent communication inserted in the *Philosophical Magazine* for April, and intended to correct some mistakes of the former communication, Mr. Kirby, in speaking of the joint of the tarsus in *Coccinella* figured by De Geer, but certainly not understood by that great naturalist, says, "He (i.e. *De Geer*) regarded this joint not as a primary but as a secondary joint, or the joint of a joint, as I am disposed to do myself, and therefore, in the *Introduction to Entomology*, and upon other occasions, I speak of the *Chrysomelidæ*, &c. as tetramerous, and the *Coccinellidæ* as trimerous." As Mr. Kirby thus continues to consider the *Chrysomelidæ*, &c. as tetramerous, and the *Coccinellidæ* as trimerous, and has thus abandoned all claim to that generalization upon which the whole use and merit of this discovery, as I conceive, hinges, I have only to say, that I have not been able to discover with him that *Cassida* has the same kind of tarsus as *Cerambyx* or *Chrysomela*. In the above-mentioned passage, cited from the forthcoming volume of the *Introduction to Entomology*, Mr. Kirby says, that in the Linnean genera *Curculio*, *Cerambyx*, *Chrysomela*, *Cassida*, &c. "the claw-joint consists of two articulations." Judging from the affinity of *Cassida* to *Chrysomela*, I thought so myself at first, but I certainly have not been able to confirm this reasoning by observation.—*May* 1825.

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his "*Coccinelle à* 15 *points noirs*," although he considered the genus as trimerous*. And the fact is, that this truly tetramerous structure prevails, as far as I have observed, throughout all the insects hitherto called trimerous: for instance, in *Eumorphus immarginatus*, a Sumatran insect, which I more particularly specify, for the same reason as the Javanese *Coccinella*, because they are both large species in a group of which the insects are generally small; and because the tetramerous structure of their tarsus is therefore visible to the naked eye.

These very remarkable facts destroy even the very nomenclature of M. Latreille's system, and throw doubt on the description of almost every genus that is not recorded as pentamerous in the *Genera Insectorum*. In this stage of the investigation, therefore, two important questions arise, which require much more development than I am able to give them in the present crude sketch. These are, first, What coleopterous genera possess only four joints to each of their tarsi? and, secondly, Considering such tetramerous tarsi as typically pentamerous, what articulation is it that is evanescent in these genera? Such are questions intimately connected with the doctrine of natural affinities, as it relates to *Coleoptera;* and I therefore beg leave to conclude this paper with a few remarks, which may be interesting to those who may be inclined to take up the subject.

Heteromerous insects are, as before said, so called by MM. Dumeril and Latreille because they have five articulations to each of the four first tarsi, and only four to each of the two last. This, as

* In his first letter to the editors of the *Philosophical Magazine*, Mr. Kirby states, on the authority of Mr. Spence, that Müller had discovered the third joint in the tarsus of *Coccinella;* but as Mr. Kirby has not been able to refer me to the work in which Müller published this discovery respecting the *Trimera* of the French system, I can only mention the fact, contenting myself, in consequence, with having been the first to make known to the public the true construction of the tarsus in the insects called *Tetramera* by the French entomologists.—*May* 1825.

far

far as I have been able to observe, is a very accurate description of all those sand insects which are allied to *Pimelia* and *Tenebrio*. The manner, however, in which a *Helops* is heteromerous may perhaps be explained by examining the posterior pentamerous tarsus of *Erotylus;* in which case we should say that it is the penultimate joint of the tarsus that is evanescent in the *Helopidæ*. In the heteromerous *Cistelenæ* of M. Latreille we have a genus *Mycterus*, evidently allied to the *Curculionidæ;* and a very careful dissection has made it appear to me that it is in reality pentamerous, only the third and fourth joints of the posterior tarsi are nearly confluent. Hence, in heteromerous insects generally, we may perhaps suppose that it is the fourth joint of the tarsus which vanishes. I say generally, because there may be many exceptions to the rule; perhaps, for instance, *Meloe* and the insects allied to it. These are true *Heteromera;* but on looking at their posterior feet we find an obconical process, which seems to represent the lost articulation, and occasions one almost to fancy, although not perhaps very philosophically, that it is the second joint of the tarsus which articulates with the tibia. The Linnean genus *Cassida* and *Alurnus* appear to have only four joints to their tarsus, which differs moreover from that of the *Chrysomelidæ*, inasmuch as all these four articulations are dilated. The affinity of *Cassida* to *Chrysomela* shows us here also which joint is evanescent; and we find, in fact, that the last joint, although dilated at the extremity, puts on the appearance of the piece formed by the two last articulations of the tarsus in *Chrysomela*. This circumstance may serve to throw light on the structure of the foot in *Eumorphus*, and the other insects commonly but erroneously called trimerous. I have shown them to be at least tetramerous; and I conceive, from analogy, that it is the penultimate joint that is here also evanescent. But however this may be, enough has been said to prove the worthlessness of the tarsal system, even

even when we consider it in no other light than as affording means of description. As a medium for expressing natural affinities, it had already been sufficiently characterized by the learned entomologist who has been the principal source of its celebrity, when he said, "*Articulorum tarsorum progressio numerica decrescens in methodo naturali non admittenda.*" This assertion I have repeatedly proved to be true, notwithstanding its having been tacitly retracted by M. Latreille, when he brought forward this system in the *Règne Animal distribué après son Organization*. To overturn, therefore, this arrangement of *Coleoptera* altogether, and to demonstrate that it does not even possess the merit of being an accurate artificial one, it only remained to show that this numerical progression of tarsal joints does not really exist in nature, and that we have been hitherto giving those very groups of *Coleoptera*, which perhaps are most familiar to our eyes, names that in point of fact are quite erroneous.